2.2 ENVIRONMENTAL CONTEXT

This section, entitled environmental context, describes existing environmental conditions within the Central Arizona Regional Framework Study Area, and identifies potential environmental concerns for future planning and development of new transportation corridors within the study area. Information presented in this environmental context is based on existing data sources from local, county, state, and federal agencies. This background information presented in this chapter may serve as input to analyze the feasibility of roadway improvements or new roadway corridors within the study area.

This chapter describes the existing natural environment within the study area in terms of geology, topography, hydrological resources, natural infrastructure (wildlife, sensitive species, and vegetation), cultural resources, air quality, and hazardous materials. Noise quality is not addressed within this study. Noise issues will be addressed as plans are developed for future site-specific projects during their design phase. Visual surveys to confirm the characteristics of the existing natural environment have not been conducted for the Central Framework Study Area, but will be required for future proposed projects prior to implementation.

2.2.1 Geology and Topography

The Central Arizona Regional Framework Study Area lies within two major physiographic provinces of Arizona—the Basin and Range Province and the Central Highlands Province (Chronic, 2006). Both physiographic provinces are identified by distinctive landscapes and geologic characteristics. The majority of the Central Framework Study Area lies within the Basin and Range Province (a broad area of low-elevation basins), alluvial fans (sediment deposited by flowing water), and bajadas (shallow slopes that lie at the base of rocky hills) divided by mountain ranges that extend over the southern and western portions of the state. Topography of the Basin and Range Province is characterized by low, flat deserts with small interjecting mountains. The northeastern corner of the Central Arizona Regional Framework Study Area lies within the Central Highlands Province, a transitional zone of high, closely spaced mountains with shallow, narrow valleys that extend from the east-central to the west-central portion of the state. Topography of the Central Highlands Province is characterized by shallow basins and terraces with high mountain ranges.

Mountains of Arizona formed over 1,700 million years ago as tectonic plates collided, pushing up the earth’s crust. Both provinces in the study area display mountains and rocks from this period and are composed of gneiss, a coarse-grained metamorphic rock, and schist, a metamorphic rock with mica flakes (Chronic, 2006). As time progressed volcanic activity occurred along these collision zones and added granite masses to the mountain ranges from the molten magma. Additionally, sedimentary deposits including marine sandstone, siltstone, and limestone, were laid throughout the area from an ancient sea (Chronic, 2006). Weathering and erosion eventually altered and reshaped the mountain ranges and created terraces, valleys, basins, and developed massive, alluvial fans and sediment deposits of sand, gravel, and cobbles which currently exists in the study area today. Unique characteristics of the Highlands Province that distinguish it from the Basin and Range Province include terraces and small shallow valleys that contain fine lake silt, lake limestone, volcanic ash deposits, salt and gypsum deposits, and a concentration of mammalian fossils from the Pliocene and Pleistocene epochs (Chronic, 2006).

Principal Landforms

Principal landforms within the Central Arizona Regional Framework Study Area include mountain slopes and ridges, hillside cliffs, alluvial fans, bajadas, valleys and basins, ephemeral and perennial waterways, riparian areas, and floodplains. Mountain regions dominate the eastern region of the study area and desert valleys dominate the western region. Waterways and drainages dissect the entire study area, with most of the waterways and ephemeral drainages in the eastern portions of the study area generally connecting with the Gila River and flowing westerly. Many of these waterways and drainages begin in narrow canyons slicing through the mountainous terrain and widening downstream as the drainages enter the lower rolling desert areas.

Key topographic features located within the Central Arizona Regional Framework Study Area are listed in Table 2.1.

Table 2.1 Topographic Features

Topographic Feature	Location
Superstition Mountains	Tri-corner area of Maricopa, Pinal, and Gila counties
Mescal Mountains	Eastern corner of Pinal County and southwest corner of Gila County near the San Carlos Reservoir
The Tablelands	East Pinal County, south of the Mescal Mountains
Tabletop Mountains	Southeastern Pinal County, south of Interstate 8
Tortilla Mountains	East Pinal County, west of Hayden, Arizona
Tortolita Mountains	Southern central area of Pinal County
Santa Catalina Mountains	Southeast corner of Pinal County and eastern Pinal County
Galiuro Mountains	Eastern Pinal County and western Graham County
Picacho Mountains	Southern area of Pinal County

Source: DeLORME 3-D TopoQuads (2002). United States Geological Survey (USGS). USGS 7.5-Minute Quadrangles, Arizona.

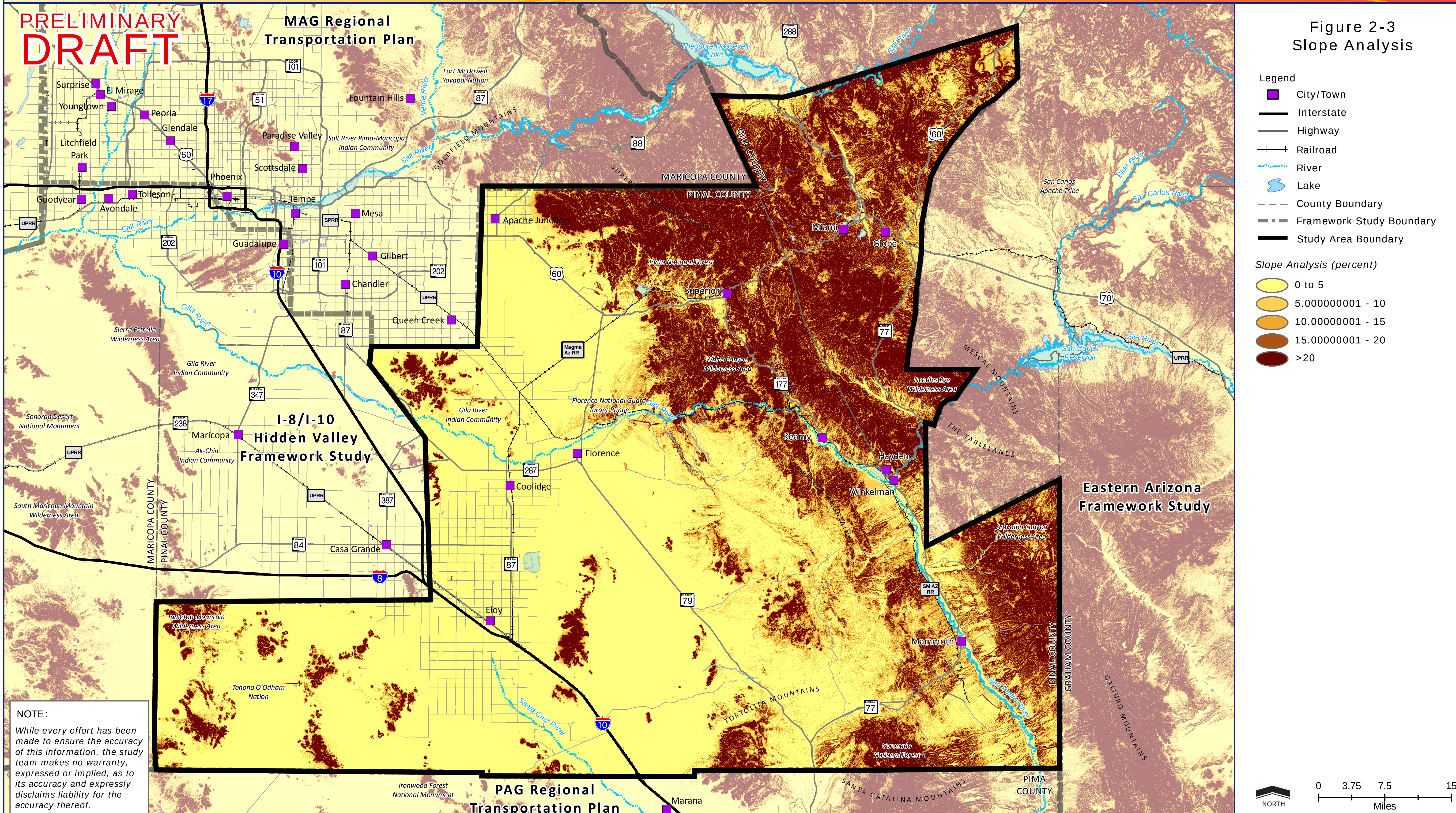
Slope Analysis

Significant mountain ranges and topographic variations exist in the eastern portion of the study area and lower desert elevations with sporadic, interjecting mountains noted in the central and western portions of the study area (Figure 2-3). Figure 2-3 depicts slope values of less than 5 percent, 5 to 10 percent, 10 to 15 percent, 15 to 20 percent, and greater than 20 percent. Areas with slopes of less than 5 percent appear virtually flat and can be easily developed with little or no need for grading. Sloped areas of 5 to 10 percent are more readily apparent to the eye, but still relatively easy to develop, with small cut and fill requirements.

Areas with slope gradients of 10 to 15 percent have noticeable inclines that require substantial site work to develop and would create visual impacts with visible cuts and fills. Slope gradients from 15 to 20 percent are steep which creates significant construction challenges and causes issues with slope stability which results in significant visual impacts. Areas with slopes greater than 20 percent present extreme challenges that result in increased project costs, slope instability issues, and impacts that are often difficult and costly to mitigate.

Regional Framework Study: Central Arizona

Figure 2-3
Slope Analysis



NOTE:
While every effort has been made to ensure the accuracy of this information, the study team makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof.

Sources: ALRIS 2007, ADOT 2007

May 8, 2008

Steep slopes can increase the potential for physical hazards, the level of difficulty for repairs and improvements, raise susceptibility to rock falls, soil slippage and erosion; visual impacts, and difficulty of slope revegetation. Data presented in Figure 2-3 shows that the large portions of the study area in northeastern and eastern Pinal County, along with the areas in Gila County, has slopes that vary from 15 percent to greater than 20 percent and present the biggest challenge for development. These areas include the Superstition Mountains, Tortolita Mountains, and areas within the Tonto National Forest, Coronado National Forest, White Canyon Wilderness area, Needles Eye Wilderness Area, and Aravaipa Canyon Wilderness Area. The central and western portions of Pinal County present slope values that are generally 5 percent or less. This is the largest area within the study area that provides substantial opportunities for development. This area includes the communities of Coolidge, Florence, Eloy, and Apache Junction. Sporadic mountains with slopes greater than 20 percent exist in the central and western regions of Pinal County, particularly within the Gila River Indian Community and on the Tohono O'Odham Nation, but the areas are small and widely spaced which creates opportunities for avoidance and circumvention.

Land Subsidence and Earth Fissures

Earth fissures are ruptures (typically long linear cracks) in the earth's surface caused by uneven or differential compaction in the surface as a result of groundwater level subsidence from over pumping. It is estimated that more than 3,000 square-miles in Arizona have been affected by subsidence. The Picacho/Eloy area of Central Arizona has been extensively documented ("South-Central Arizona, Earth Fissures and Subsidence Complicate Development of Desert Water Resources", Carpenter, Michael C. U.S. Geological Survey, Tucson, Arizona, undated).

Earth fissures have caused significant damage to infrastructure and property including roads, railroads, flood control structures, utilities, and housing developments. Fissures will need to be considered in the design and alignment of new transportation corridors. Ideally, known fissure zones will be avoided.

Earth fissures are caused by areas of land subsidence. Fissures develop a surface expression of tension in the soil between the cone of depression of the groundwater extraction area that begins to subside and the areas that are not subsiding. The tensile strength in the soil is not strong enough to hold together and soil cracks. Some fissures in the study area measure 50 feet wide and 10 feet deep. The fissures are exposed by surface water runoff from rainfall or irrigation.

Land subsidence has occurred in the study area where water used for agriculture and urban development has led to overdrafting the region's groundwater. After removing groundwater, the aquifer collapses and compresses. Water levels in the aquifers are lowered when pumping is initiated and the basin fill sediments are dewatered. If water in the aquifer is taken out at a higher rate than it can be replaced, then the water level in the aquifer is lowered. The weight of the soil above the aquifer compresses the aquifer and results in a general lowering or subsiding of the land. Some estimates indicate that there has been as much as 12 feet of subsidence near Eloy and six feet near Queen Creek. (*Land Subsidence in Central Arizona*, Winikka, C.C., Wold, P.D., International Association of Hydrological Sciences. Preceeding of the Anaheim Symposium, December, 1976.)

Several studies that have been completed in the study area have documented land subsidence and potential earth fissure locations. The United States Bureau of Reclamation (USBR) studied subsidence and potential earth fissures extensively for the construction of the Central Arizona Project (CAP) canal. Studies in the Hawk Rock area in the northeast portion of the study area have been published by the USBR (*Salt-Gila Aqueduct Reach 1, 2, and 3, Subsidence Study*, Bureau of Reclamation (BOR), April, 1991; and "File SGA123C.WK1", U.S. Bureau of Reclamation, Arizona Projects Office, October 26, 1992).

The Natural Resources Conservation Services (NRCS) has also studied and investigated potential earth fissures in areas near any flood retarding structures they designed. In the past several years, the Arizona Department of Water Resources (ADWR) has successfully used Interferometric Synthetic Aperture Radar to estimate subsidence from satellite photos in areas of Arizona. ADOT and the United States Geologic Survey (USGS) have also studied land subsidence and potential fissure locations in the study area.

An earth fissure was first documented near Picacho in 1927 and has grown to over 10 miles long. Several fissures have been identified in the study area near Picacho, Queen Creek, and Eloy.

2.2.2 Hydrological Resources and Issues

All major watercourses in the study area are tributaries in the greater Gila River watershed. The smaller watersheds include the San Pedro River, the Santa Cruz River, Queen Creek, and the Salt River. All of these watercourses ultimately discharge into the Gila River.

Major Watercourses and Drainage Features

The Gila River is the major drainage watercourse in the study area. The Gila River traverses Pinal County from east to west through the middle of the study area. The river runs through the Needles Eye and White Canyon wilderness areas, crosses state routes 77, 177, 79 and 87, and runs parallel to the Copper Basin Railroad and a branch of the Union Pacific Railroad (UPRR) in a portion of the study area.

The San Pedro River runs from south to north in the southeast corner of the study area, and ultimately converges with the Gila River near the town of Winkelman. The San Pedro runs parallel to SR 77. Aravaipa Creek is a tributary to the San Pedro River.

The Santa Cruz River is located in the southern portion of the study area and runs from south to north parallel to a portion of I-10. The Santa Cruz River is less defined as it crosses the Pima County border into Pinal County, becoming shallower and wider. The river bed continues to have very little definition north and east of Picacho and Eloy. The Santa Cruz River discharges into the Gila River north and east of the study area, in the Gila River Indian Community near the Maricopa County line.

Queen Creek flows from east to west across northern portion of the study area. The headwaters are in the mountains above Superior. Queen Creek crosses US 60 north and west of Florence Junction, and discharges into the East Maricopa Floodway west of the study area boundary. The floodway, in turn, discharges into the Gila River outside the study area. As a result of significant flow in the 1954 Queen Creek storm, the Whitlow Ranch Dam, an 80-foot-tall earthen embankment dam, was constructed on Queen Creek by the U.S. Army Corps of Engineers to protect downstream population centers from flooding. The dam is located upstream of Queen Valley.

The northeast portion of the study area is in the Salt River watershed. Pinto and Pinal creeks near Miami and Globe flow into the Salt River upstream of Roosevelt Lake.